

PERSISTENCE OF VISION

A new season beckons, and how's it all looking for you? **Edward Lyons** starts his new series on the visual system and how it can effect how often we dust our clays

It all starts with the eyes. As we all know, we can't hit what we can't see and so shooting and vision are absolutely linked. Over the next three issues of *Clay Shooting*, we will be delving deep into the biological and mental aspects of our visual system. We'll examine how it works, why it stops working and how we can remedy the latter through the use of prescriptions, eyewear, contact lenses, laser treatment and vision training.

Approximately 90 per cent of all sensory information that we take in when we are awake is visual, so it makes sense to ensure our eyes are performing at their best. In a perfect scenario, it only takes a matter of milliseconds for our visual system to inform us when a target is presented, its speed, trajectory and position in space. It is then the job of the motor system to facilitate smooth hand-eye coordination to break the clay.

How does this happen and what problems can arise?

We often acquire a target peripherally and then use our central vision to maintain fine focus on the bird. It's important to remember that the barrels should remain purely in our peripheral

vision. Bouncing fixation from the bead to the bird or chasing the lead can mean that our eyes get stuck in 'no man's land' between the barrels and the target.

In an ideal situation, light from a target passes through the ocular media smoothly and is accurately focused on the retina. The basic pathway is as follows: tear film, cornea, pupil, lens, vitreous and then retina.

Tear film

Our tears are made of three main layers. A mucin layer sticks the tears to the eye, helping to nourish the cornea beneath and aiding the next watery layer in sliding evenly over the surface. This watery layer helps prevent infections and washes away debris. The outer layer of our tear film is oil- or lipid-based, and it seals the tear film and reduces evaporation. Different types of dry eye conditions disrupt these layers and can have detrimental effects on our sight, as well as the comfort of our eyes.

The cornea

Our cornea is the outermost layer of the eye and is a highly organised, sensitive tissue that comprises 65 to 75 per cent of our focusing



Keeping your eyes healthy is essential for good shooting

power. It can be affected by dry eye, types of dystrophy and foreign bodies.

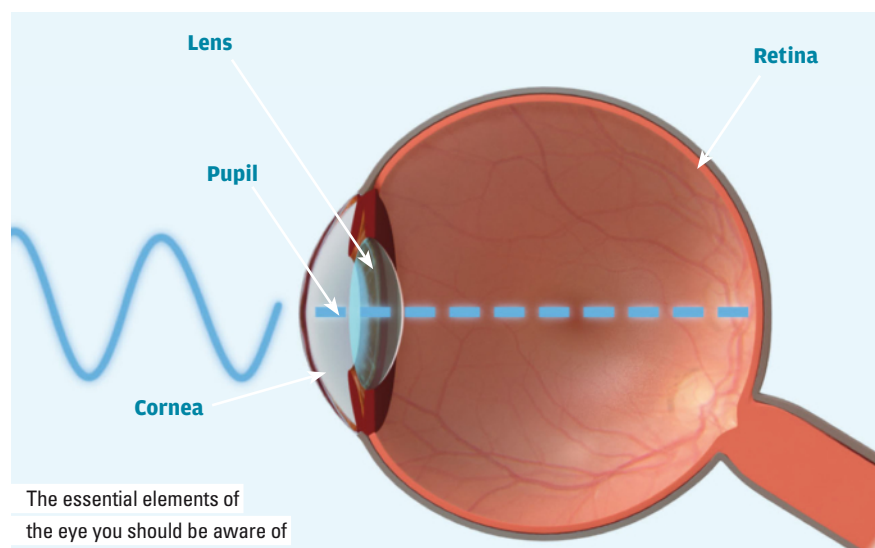
The pupil

The pupil is the opening in the centre of the iris (the structure that gives our eyes their colour). Its function is to allow light to enter the eye so that it can be focused on the retina to begin the process of sight.

Typically, pupils appear to be perfectly round, equal in size and black in colour as, in normal lighting, light that passes through is absorbed by the retina and not reflected back). Together, the iris and pupil control how much light enters the eye. Using the analogy of a digital camera, the pupil is the aperture of the eye while the iris is the diaphragm that controls the size of the aperture.

The old adage of 'use the palest lens to allow the most light into your eye' comes from this but it is not always appropriate advice for all. Some shooters are rather light-sensitive and so need a darker lens to preserve visual comfort. Any visual advantage that may be induced by a small pupil is dramatically countered by disabling glare.

Errors or differences in pupil size and behaviour can be physiological – you may have been born with them – or they could indicate potentially serious general health issues.



The essential elements of the eye you should be aware of



The lens

Inside each eye, we have a lens. The lens is a transparent, biconvex structure that, along with the cornea, helps to refract light onto the retina, enabling us to see.

As we get older, the lens often loses some of its elasticity and the process of fine focus can become more difficult. This first becomes apparent when we find ourselves needing reading glasses.

As we get older still, it also becomes cloudy, changing our colour perception, reducing our focus and eventually developing a cataract that calls for surgical removal.

The vitreous

The vitreous was covered in last year's article about floaters, the annoying whirly squiggly things that drift around in your vision. It's a clear, colourless fluid that fills the space between the lens and the retina of your eye. Made up of 98 per cent water and two per cent collagen, it must remain clear in order to not impair the light path to the retina.

The retina

The retina marks the finale of light's movement through the eye. There, visual images are registered by the rod and cone cells, which are able to convert light into electrical impulses and

then transmit them to the brain through the optic nerve.

The retina is a layer of nervous tissue that covers the inside of the back two-thirds of the eyeball, in which stimulation by light occurs, initiating the sensation of vision. It is actually an extension of the brain, formed embryonically from neural tissue and connected to the brain proper by the optic nerve.

The most common cause of damage to the retina that I see in practice is that caused by diabetes. If you are diabetic, it is vital to keep your blood levels stable.

VISUAL SKILLS

Visual acuity – Sharpness of vision

Visual acuity is the term used to denote the best standard of retinal sharpness one can achieve in a natural state, or using glasses or contact lenses if required. It's best to think of our eyes as a pair of video cameras and the higher resolution, the better. A high level of visual acuity should allow faster target acquisition and identification of the bird as it passes across complex backgrounds.

We can be short- or long-sighted, or have astigmatism, and still achieve a high visual acuity as long as the error is accurately corrected. The well-known American '20/20' standard does not denote perfect vision – simply put, it means that someone can see a target at 20 feet away that has been designed to be seen from 20 feet away. 20/20 is actually average and many top-level shooters will exceed this by some degrees.

Often in my practice, once a high level of visual acuity has been achieved through enhanced prescription lens technology, I regularly receive feedback about how scores have subsequently increased. While some studies have shown that high visual acuity is not a prerequisite for shooting success, my experience of assessing the visual skills of club, county and international shooters suggests otherwise – the better shooters often have a higher standard of visual acuity.

However, while this is undoubtedly important, it is only one of a number of key visual skills that successful shooters will typically excel in.

Binocular vision and oculomotor balance – Eye teamwork

This term refers to how well the eyes operate together and how well they continue to work when the system is stressed. We can have eyes that are perfectly focused but may not function well together. This can affect performance consistency and the perceived



Having regular eye tests will help you to uncover any possible issues

location of a clay. To achieve clear binocular vision, both eyes should be pointed at the object so that the images fall on corresponding points of the two retinas. If this is done incorrectly, double vision can occur.

True double vision is not to be confused with physiological diplopia, a normal phenomenon in which objects not within the area of fixation are seen as double. When someone with normal vision focuses on an object, everything in front of the object appears double, and everything behind the object appears double. This is suppressed in everyday life but is often reported by shooters as 'seeing two barrels' when staring at a clay. This does not mean that shooters have eye dominance issues or should close an eye, unless there are other problems going on at the same time.

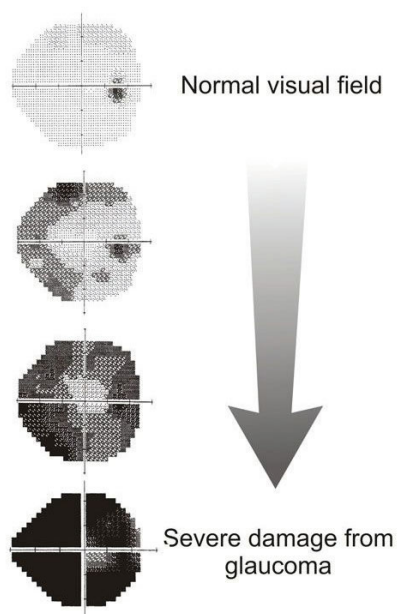
Errors with our oculomotor system, or eye muscles, will lead to inaccurate tracking, eye dominance problems, eye fatigue and inconsistency, among other things.

Fusional reserves – Eye muscle strength and flexibility

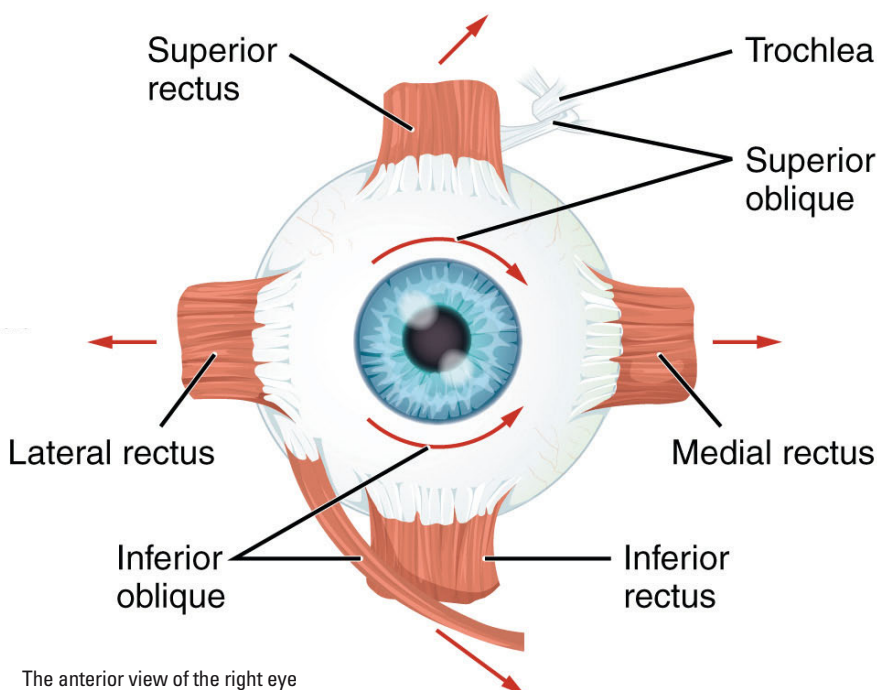
Poor performance here can lead to transient dominance shifts and general visual fatigue. This can be assisted with visual training exercises, if deemed appropriate.

Stereopsis – Accuracy of depth perception

Depth perception can often be negatively affected by binocular vision inefficiencies. Some forms of laser treatment and contact lens use will impair stereopsis, as will closing an eye. However, there are some fantastic



Your visual field can be adversely affected by conditions such as glaucoma



shots whose shooting performances aren't negatively affected by limited stereopsis at all.

Eye dominance – Which eye is 'in charge'

Unstable eye dominance will affect balance, aiming and target acquisition. Its relationship with handedness can have a dramatic effect on how well a shooter will perform. Simply put, if there is an error here, the gun may not be pointing where the eyes are looking.

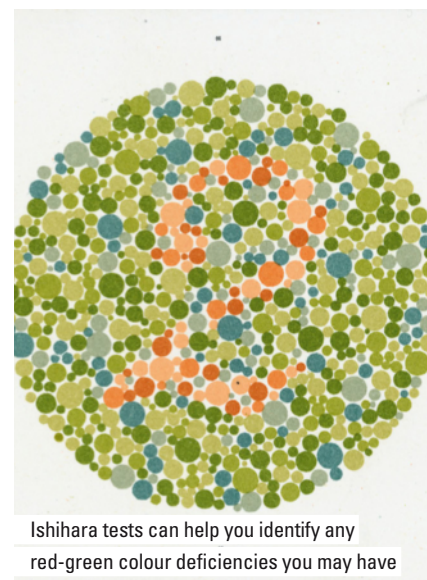
However, we know there are some excellent shooters who do not have perfect right hand/right eye or left hand/left eye dominance but through experience and practice, they have learned the correct sight pictures. The most frustrating issue is when the eye dominance fluctuates, so we lose our visual consistency.

As our visual system is muscular, it is worth remembering that our eye dominance can become affected by stress, tiredness, dehydration, glucose levels, hormone levels and even reactions to some medications.

Visual field and peripheral awareness – The vision around you and how you integrate information in it with your central vision

Our visual field is essentially what we can see out of the corner of our eye – that is, if we are focussing on a central target, what we can perceive around this.

Scotoma is the term given to an altered or reduced area in our visual field. The field can be lessened permanently or temporarily by physical conditions such as glaucoma and migraines. Large noses, poor gun fit



Ishihara tests can help you identify any red-green colour deficiencies you may have

and inappropriate eyewear can also cause scotomas, as can very serious general health issues like strokes and brain tumours.

Colour vision and contrast sensitivity – Ability to see subtle differences in colour and grey tones in a range of lighting levels

Everyone's visual system is different, which is why tint selection for shooting glasses is very specific to the individual. Fortunately, there are now a very wide range of tints available to suit most frames and all budgets.

An assessment of a shooter's visual skillset will ascertain whether there are any specific strengths or weaknesses that can be tackled and enhanced through eyewear solutions and vision training, and these will all be discussed in upcoming issues. ●